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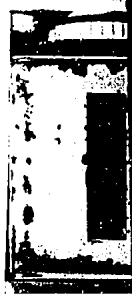

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MODERN ASPECTS OF HEMATOLOGY AND BLOOD TRANSFUSION

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The joint Pavlov session of two academies [Academy of Sciences USSR and Academy of Medical Sciences USSR] brought a radical change in our basic concept of the mechanism of the action produced by blood transfusion.

Some time ago, A. A. Bogolyubov, member of the academy, presented his hypothesis of colloidoclastic shock in explanation of the stimulation caused by a blood transfusion. This theory was based mainly on the changes in the chemical composition and the colloidal characteristics of the recipient's blood after a transfusion. Special attention was drawn to changes in the serum proteins, which have been proven to be subject to quantitative and qualitative fluctuation.

The contemporary concept of physiology and medicine required a radical revision of this theory, built entirely on narrow humoral principles. The falsity of the concept that a colloidoclastic crisis is the first stage in a complicated biological reaction of the recipient to the introduction of new blood became clear.

There is no more doubt that all the hidden processes appearing in an organism following a transfusion develop in close correlation with the nerve system, primarily its central sections.

Lately, N. A. Fedorov and his co-workers, A. M. Namyatusheva, N. A. Messineva, I. I. Zaretskiy, V. M. Rodionov, and B. I. Khodorov, have developed their research on the mechanism of effects produced by newly introduced blood. Modern methods of research demonstrated that protein changes in plasma are only partial demonstrations of posttransfusion activation of the exchange process between blood and tissues. Regeneration of the protein content of blood during the posttransfusion period reflects the passage of finely dispersed reserve proteins of the albumin type from the tissues into the blood. Especially important in this process are the tissues of the

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intestines and the liver. It is in these organs that most of the protein synthesis takes place, and that is where most of the reserve proteins are stored. The process of an increased exchange between blood and tissues is one of the essential components in the complex reaction of the entire organism to a blood transfusion. It was clearly demonstrated that this process has no independent and guiding significance, as was believed by A. A. Bogomolets.

Simultaneously with the exchanges in the protein content of the blood, a series of displacements appears in the vegetative functions of the organism: a two-phase change in the water-salt metabolism, an increase in sugar utilization by tissues of the recipiert, a change in the basal metabolism, changes in heat regulation, and a stimulation of blood formation.

On the basis of recent research, it may now be conclusively accepted that all these vegetative changes are caused by corresponding functional changes in the cortex and subcortical centers. On this basis, it becomes interesting to invertigate the functional changes in the cerebral cortex which are produced by a blood transfusion.

Experiments demonstrated that blood transfusion caused certain changes in conditional reflexes. These changes are directly dependent on the type of higher nervous activity peculiar to the animal. It should be noted that the regeneration of blood proteins occurs simultaneously with the return of conditional reflex activity to its original level.

I. I. Fedorov, Lvov, believes that the biochemical and morphological changes in blood composition caused by the introduction of new blood play an important part in affecting the reflectory apparatus and higher nerve centers. Fedorov emphasizes the importance of the location and speed of blood injection, as well as of the general condition of the recipient.

Experiments conducted by M. L. Garfunkel, N. M. Nemenova, and others demonstrated that the use of narcotics did not fully eliminate complications arising on introduction of noncompatible blood. This disproved the mistaken theories of certain authors who regarded as admissible the transfusion of large doses of noncompatible blood under narcosis.

Worth noticing is the work of Docent G. D. Gaibov, who conducted research on the participation of the cerebral cortex in bringing about the shock condition caused by a blood transfusion. He found that in animals with the cortex wholly or partly removed, the shock caused by a blood transfusion took a severe form, while normal animals reacted to a considerably lesser degree. The research worker in this case observed a conditional reflex reaction of the hemotransfusion shock type.

The effect of the secondary signal system on cardiovascular action and certain biochemical and morphological indices of peripherial blood in donors was studied by C. A. Akopyan and C. N. Alaverdyan. Their observations showed that in a human being, a conditional reflex is produced by operating-room surroundings and the technique of withdrawing blood. They found that by verbal suggestion they could bring about an alleviation of the mental disturbances caused by the blood-withdrawal technique.

All this indicates the necessity of enlarging and elaborating the study of reactions by which the recipient's organism responds to blood transfusion in cases of organic and especially functional interruptions in the operation of central and peripheral nerve systems. In these research studies, wide use should be made of the conditional reflex method.

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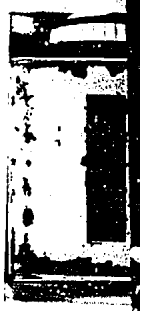

An increase in our knowledge of the mechanism of effects of blood transfusion will allow us to extend further the range of indications for hemotherapy in connection with various pathological processes.

A great gain has been achieved in the differentiation of indications for hemotherapy in preoperative and postoperative periods connected with such major surgical interferences as removal of the esophagus, lungs, stomach, or spleen. (A. N. Bakulev, V. I. Kazanskiy, D. M. Grozdov, and M. D. Patsiora).

Beneficial results have been noted following administration of repeated blood transfusions to oncological patients over long postoperative periods. At the Central Institute of Hematology, serotherapy has been successfully used in the treatment of protein deficiency. Kh. Kh. Vlados and A. P. Belousov demonstrated the efficiency of plasmotherapy followed by whole blood transfusion in cases of hemolytic anemia. Transfusions for the purpose of immunizations are being used increasingly in the treatment of infectious diseases.

Following the research data obtained by V. A. Ravich-Shcherbo, T. P. Panchenko, P. M. Maksomov, and A. D. Brodskiy, the prevailing views on the application of the method of blood transfusion for the treatment of tuberculosis of the lungs underwent a change. This disease has now been eliminated from the list of those contraindicating blood transfusions.

The clinical-experimental work of E. M. Tareyev, I. I. Zaretskiy, and others, furnished the basis for the solution of an outstanding problem i. e. the wide use of transfusions of blood and its components in certain kidney diseases.

Differentiated indications have been worked out for blood transfusions in diseases of the liver (M. S. Dultsin, N. A. Kraevskiy, P. M. Alperin, N. S. Rozanova). It has also been demonstrated that gamma globulin is effective in the treatment of Botkin's disease.

Blood transfusions have become firmly established as a part of routine medical treatment under diverse pathological conditions. It should be noted that the importance of any hemotherapeutic treatment is now considered not only from an angle of increasing or limiting its application in individual posological cases, but also on the basis of a thorough study of the initial condition of the recipient's organism.

The reactivity of the patient's organism is made a subject of study. This is especially adhered to in the standard treatment of gastric and intestinal ulcers. In cases when ulceration is complicated by hemorrhage we consider as most effective treatment the introduction (transfusion) of whole blood and erythrocytic mass. In cases where there are no hemorrhagic complications, best results are obtained by the introduction of small amounts of noncompatible or even heterogenous blood.

However, such treatment cannot be used in patients with a high vascular reactivity, such as that expressed by a hypotonic condition. In such cases, we use an injection of serum, which has a beneficial effect on the action of the vascular nerve system.

In certain pathological conditions, M. C. Dultsin obtained positive results by using hemotherapy in combination with the administration of various drugs affecting the higher subdivisions of the central nervous system.

Emphasizing the importance of therapeutic protective inhibition, D. M. Grozdov rightly remarked that the rational therapy for a severe loss of blood due to operational, traumatic, or burn shock so far must remain complex. Together with the use of transfusion of blood and its components, it is important to use antishock liquids containing narcotics and sedatives.

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The problem of hemotherapy is closely connected with that of isoserology. It is important in this case to study the mechanism of group serological reactions. During the past year [1951] great progress was attained by research in the field of blood preservation, therapeutic blood preparations, and blood substitutes. As a result of exhaustive research in this field, new methods of blood preservation have been found. These methods have proved highly effective and have paved the way for further progress.

The research work of C. E. Severin and his associates has contributed a great deal to the problem of erythrocyte preservation by the use of glucose and coenzymes. Deserving of praise is the work by P. C. Vasil'yev and his associates, in regard to the effect of preservative media on the stabilization of proteins in erythrocytes. Data compiled from this research project has been adapted as a basis for creating conditions favorable for the preservation of erythrocytes.

Together with F. P. Vinograd-Finkel' and P. A. Ruthberg, we investigators [at the Central Institute of Hematology and Blood Transfusion] worked out a new method of preserving blood and its components without the use of stabilizers by using the process of ion exchange. Blood preserved by this method closely resembles in its biophysical and physicochemical properties the blood circulating in the blood stream. This method also permits the obtaining of leucocytes as a new transfusion medium used when specific indications for this are encountered in medical practice. Recent research achievements of Soviet scientists in regard to the application of active antiseptics, i.e., sodium sulfacyl [sulfanil acetamide], synthomycin, as well as other domestic preparations, deserve to be taken into consideration. Formulas have been worked out allowing the addition to the preserved blood of drugs which contribute to preservation.

At the Central Institute of Hematology and Blood Transfusion, the problem of regulating blood formation through the medium of the nerve system is studied simultaneously in several experimental laboratories. During the past 18 months a considerable amount of data has been compiled. The data obtained demonstrates a direct neurotrophic effect on the function of hemopoiesis.

In cases where there is an interruption of this function, a sharply defined degeneration of white cells and elements of the megakaryocytary apparatus appear in the bone marrow. This degeneration eventually develops into atrophy of the bone marrow. Worth noticing is the fact that the blood cells from even partly denervated marrow show reduced life capacity when cultivated outside the organism. Specific experiments demonstrated that such cells have less life capacity under conditions of tissue cultivation than the elements of a normal bone marrow.

It can now be accepted as proven that the gastric juice of healthy human beings and animals contains a substance capable of hemopoietic action. Lately, the importance of the nerve factor in the formation of hemopoietic substances of the stomach has been demonstrated by A. M. Namyatusheva and M. G. Kakhetelidze. Numerous experimental investigations gave a direct indication of the decisive influence of the nerve system (the vagus nerve) on the formation of the hemopoietic factor in the stomach.

Of great interest are observations on mice of the effects of an overstrain of the central nerve system on the functions of the blood-forming system and the development of experimental leukoses. Experiments demonstrated that in cases when experimental neurosis was produced in mice, a number of functional disturbances was observed, namely, those of the vegetative nerve system and the endocrine system. This was accompanied by sharply defined phenomena of skin dystrophy.

Changes in the blood formation have also been observed, such as the appearance of hypochromic anemia, manifestations of anisocytosis in peripheral blood, and presence of young, undifferentiated cells of the myeloid

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type. In the bone marrow of such animals, there were manifestations of irritation of the white stump and the megakaryocyte system, as well as a severe depression of erythrocytic hemopoiesis.

Overstrain of the central nerve system affects the development and the course of experimentally produced spontaneous and inoculated leukoses. Experiments demonstrated that in neurotic mice, leukoses are expedited and assume a more severe form.

Also worth mentioning is experimental clinical data obtained by Professor M. D. Tushinskiy, demonstrating the reflex action of the liver on the regulation of the blood composition.

N. C. Rosanova and E. A. Zhukov clearly demonstrated the participation of the spleen in formation of the blood marrow. Disruption of the nerve connections of the spleen as a rule resulted in drastic dystrophic changes in the blood-forming tissues of the bone marrow. Similar data were obtained by M. D. Patsiora in his clinical observations.

Of theoretical and practical interest are the normal myelogram and hemogram worked out by Kh. Kh. Vlados and F. E. Faynsteyn, this work giving the clearest presentation of functional-morphological hemopoiesis. Kh. Kh. Vlados differentiated a new type of leukosis, to wit, hemocytoblastosis with specific clinical and morphological characteristics.

Essential clinical questions of etiology, pathogenesis, and the therapy of hematological diseases depend on a widening scope of our knowledge of the intimate process by which blood formation is affected by the nerve system. The outstanding problem is to obtain a definite answer explaining the effects of the nerve centers and the cerebral cortex on hemopoiesis.

At the 13th scientific session of the Central Institute of Hematology and Blood Transfusion, such outstanding problems were discussed. Further discussions and exchanges in opinions and experiences will undoubtedly contribute to the development of research in hematology and blood transfusion.

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